



**PATENT**  
**Docket No. 1082-372**

FEB 11 2002 BY THE UNITED STATES PATENT AND TRADEMARK OFFICE

### In re Application of:

SANDERSON et al.

Entitled: "SYNTHESIS OF ENERGETIC  
THERMOPLASTIC ELASTOMERS  
CONTAINING OLIGOMERIC  
URETHANE LINKAGES"

Serial No. 09/436,440

Filed: November 9, 1999

Assistant Commissioner  
for Patents  
U.S. Patent and Trademark Office  
Washington, D.C. 20231

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February 11, 2002  
9. 2002 = Saturday]

## **BRIEF ON APPEAL**

Dear Sir:

In response to the final Office Action dated August 9, 2001, Applicants submit herewith this Brief on Appeal in triplicate as required by 37 C.F.R. § 1.192. A Notice of Appeal was filed on November 9, 2001. Applicants respectfully submit that this appeal is proper, since the claims have been twice and finally rejected.

If any additional fees are due in connection with the filing of this Brief on Appeal, please charge our Deposit Account No. 501324 and accept this paper as a petition for extension.

**(1) REAL PARTY IN INTEREST**

The real party in interest is Alliant Techsystems Inc., the assignee of record of the above-identified application.

**(2) RELATED APPEALS AND INTERFERENCES**

There are no related appeals and/or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) STATUS OF THE CLAIMS**

Claims 1-11 and 33-41 remain pending.

Claims 1-11 and 33-41 stand rejected.

**(4) STATUS OF AMENDMENTS FILED SUBSEQUENT TO FINAL REJECTION**

An Amendment under 37 C.F.R. § 1.116 was filed on December 18, 2001. In an Advisory Action dated January 18, 2002, the Examiner stated that the Amendment would be entered upon the timely submission of a Notice of Appeal and Appeal Brief with the requisite fees.

A Second Amendment under 37 C.F.R. § 1.116 has been filed concurrently herewith to cancel claims 31 and 32. Inasmuch as this Amendment reduces the number of issues on appeal and does not raise any new issues, its entry is in order.

**(5) CONCISE EXPLANATION OF THE INVENTION**

The invention relates to energetic thermoplastic elastomers that are useful as binders for energetic compositions, such as rocket propellants, gun propellants, munitions, and gas generants. (Page 1, lines 10-13.)

In accordance with an aspect of the invention, the thermoplastic elastomer comprises A blocks and B blocks connected to one another via linking groups derived from a difunctional oligomer, preferably a difunctional urethane oligomer diol. The A blocks are the "hard" or crystalline polyether blocks derived from monomers comprising at least one member selected from the group consisting of oxetane derivatives and tetrahydrofuran derivatives. The A blocks are crystalline at temperatures below about 60°C. The B blocks are the "soft" blocks derived from monomers comprising at least one member selected from the group consisting of oxetane and derivatives thereof, tetrahydrofuran and derivatives thereof, and oxirane and derivatives thereof. The B blocks are amorphous at temperatures above -20°C. Both the A blocks and the B blocks are terminated with isocyanate-reactive groups, such as diols. (Page 5, lines 1-10.)

To effect linking, the A blocks and B blocks are capped with diisocyanates. The isocyanate-capped blocks are then linked together with the difunctional oligomer. The structure and length of the difunctional oligomer may be varied to tailor the properties of the resulting thermoplastic elastomer. (Page 5, lines 10-15.)

According to one preferred embodiment of the invention, the difunctional oligomer comprises a urethane reaction product of at least one

diol and at least one diisocyanate, the diol being selected from the group consisting of ethylene glycol, propylene glycol, butylene glycol, 1,4-cyclohexanedimethanol, and any combination thereof. (Page 15, lines 27-30.)

According to another preferred embodiment of the invention, the difunctional oligomer comprises a reaction product of at least one diol and at least one diisocyanate, the diisocyanate being selected from the group consisting of hexane diisocyanate, methylene-bis(4-phenyl isocyanate), phenylene diisocyanate, toluene diisocyanate, xylylene diisocyanate, and any combination thereof. (Page 15, line 31 to page 16, line 2.)

In accordance with another preferred embodiment of the invention, the A blocks are derived from at least one member selected from the group consisting of 3,3-(bis(ethoxymethyl)oxetane, 3,3-bis(chloromethyl)oxetane, 3,3-bis(methoxymethyl)oxetane, 3,3-bis(fluoromethyl)oxetane), 3,3-bis(acetoxyethyl)oxetane, 3,3-bis(hydroxymethyl)oxetane, 3,3-bis(methoxyethoxymethyl)oxetane, 3,3-bis(iodomethyl)oxetane, 3,3-bis(nitratomethyl)oxetane), 3,3-bis(methylnitraminomethyl)oxetane, and 3,3-bis(azidomethyl)oxetane), and the B blocks are derived from at least one member selected from the group consisting of 3-hydroxymethyl-3-methyloxetane, 3-octoxymethyl-3-methyloxetane, 3-chloromethyl-3-methyloxetane, 3-azidomethyl-3-methyloxetane, 3-iodomethyl-3-methyloxetane, 3-propynomethylmethyloxetane, 3-nitratomethyl-3-methyloxetane, 3-methylnitraminomethyl-3-methyloxetane, tetrahydrofuran, glycidyl azide, and glycidyl nitrate. (Page 7, line 15 to page 8, line 7.)

The increased length of the oligomeric linking groups (compared to, for instance, a non-oligomeric diol) increases the softening temperature of the

polymer. In tactical and other extreme environments, the polymer should be capable of maintaining its structural integrity without creeping or slumping. (Page 3, lines 22-31.)

**(6) CONCISE EXPLANATION OF THE ISSUES PRESENTED FOR REVIEW**

(1) Whether claims 1-11 are indefinite under 35 U.S.C. § 112, second paragraph.

(2) Whether claims 1-11 and 33-41 are rendered unpatentable under the judicially created doctrine of obviousness-type double patenting over claims 1-13 of copending patent application 09/436,360.

(3) Whether claims 1-11 and 33-34 are obvious under 35 U.S.C. § 103(a) over U.S. Patent No. 4,806,613 to Wardle in view of Oertel, *Polyurethane Handbook: Chemistry - Raw Materials - Processing - Applications - Properties*.

**(7) GROUPING OF THE CLAIMS**

Claims 1-4, 7-11, and 34-40 stand or fall together, but alone from all other active claims of the application.

Claims 5 and 37 stand or fall together, but alone from all other active claims of the application.

Claims 6 and 38 stand or fall together, but alone from all other active claims of the application.

Claims 33 and 41 stand or fall together, but alone from all other active claims of the application.

**(8) ARGUMENTS**

**(a) *A Person of Ordinary Skill in the Art Would Not Have Considered Claims 1-11 Indefinite under 35 U.S.C. § 112, Second Paragraph***

In numbered paragraph 8 of the final Office Action, claims 1-11 were rejected under 35 U.S.C. § 112, second paragraph, as indefinite on the following ground:

It is unclear if the A block containing segment and the B block containing segment are mutually exclusive, since both segments may be crystalline below -20°C and amorphous above 60°C. Under the aforementioned conditions, the requirements of both segments would be met by a single constituent.

This rejection is traversed.

It is an axiom of patent law that a claim must be interpreted as it would be by one of ordinary skill in the art. ***Such skilled artisans understand that blocks of the type described in the application have a transition point below which the blocks are crystalline and above which the blocks are amorphous.***

The Examiner states that “both segments may be crystalline below [about] -20°C and amorphous above [about] 60°C.” This is true. However, if the A block is crystalline at about 60°C, it will remain crystalline if cooled below about 60°C. Likewise, if the B block is amorphous at about -20°C, it will remain amorphous above about -20°C. Thus, the A and B blocks are in

different states between about -20°C and 60°C and, therefore, are mutually exclusive.

The *clear and ordinary meaning* of the claim language “the A block being crystalline below about 60°C,” as understood by a person of ordinary skill, would have been construed to mean that the A block is crystalline at all temperatures below about 60°C.

To construe claim 1 as the Examiner has done here would render the claim language “below about 60°C” *meaningless and superfluous*. The Examiner contorts the claim language to read on a block that is crystalline at *any* temperature below 60°C, even if that block is not crystalline at all temperature below about 60°C. (Thus, the Examiner’s interpretation of claim 1 would read on, for example, a block that is amorphous above about 2°C but crystalline below about 2°C.) However, all polyether blocks (of the type set forth in claim 1) inherently turn crystalline if cooled to low enough of a temperature. The Examiner’s contorted interpretation of the claim language has no meaningful limiting effect whatsoever on the scope of the claims, renders the claim language superfluous, and, therefore, would not have been considered the normal and ordinary meaning of the claims by a person of ordinary skill in the art.

Similarly, the *clear and ordinary meaning* of the claim language the “B block being amorphous above about -20°C,” as understood by a person of ordinary skill, would have been construed to mean that the B block is amorphous at all temperatures above about -20°C. The specification supports this interpretation. Page 6, lines 17-18 recites that the “B blocks are amorphous *down to about -20°C*.” (Emphasis added.) To construe claim 1 in

any other way, such as the Examiner has done here, would render the claim language “above about -20°C” *meaningless and superfluous*, and would be incongruous with the specification. The Examiner contorts the claim language to read on a block that is amorphous at *any* temperature above -20°C, even if that block is not amorphous at all temperatures above about -20°C. (Thus, the Examiner’s interpretation of claim 1 would read on, for example, a block that is amorphous above about 40°C but crystalline below about 40°C.) However, all polyether blocks (of the general type recited in claim 1) inherently turn amorphous if heated to high enough of a temperature. The Examiner’s contorted interpretation of the claim language has no meaningful limiting effect whatsoever on the scope of the claims, would render the claim language superfluous, and, therefore, would not have been considered the normal and ordinary meaning of the claims by a person of ordinary skill in the art.

It is respectfully submitted that all claims are in full compliance with 35 U.S.C. § 112, and that the Section 112, first and second paragraph rejections should be reversed.

**(b) *The Claims of Co-Pending Application 09/436,360 Do Not Disclose or Reasonably Suggest All of the Features of Claims 1-11 and 33-41, and, Therefore, Do Not Render These Claims Unpatentable Under the Judicially Created Doctrine of Obviousness-Type Double Patenting***

In numbered paragraph 2 of the final Office Action, claims 1-11 and 33-41 were provisionally requested under the judicially created doctrine of obviousness-type double patenting over claims 1-13 of copending application 09/436,360.

Applicants continue to traverse this rejection.

The claims of the '360 application are silent with respect to the claimed "difunctional oligomer."

In the final Office Action, the Examiner asserts that "the term, 'difunctional oligomer,' is fully encompassed by the difunctional compound of the copending application." Applicants disagree.

The term "oligomer" recited in the claims of this application is known in the art and described in the specification as a molecule containing a plurality of monomer units. As stated by the Examiner, the claims of co-pending application 09/436,360 recite a difunctional compound, but give no reasonable suggestion or teaching that the difunctional compound is anything other than a simple diol (e.g., butanediol). Given the lack of teaching of using an oligomer for the linking compound, the requisite motivation is missing, and it would not have been obvious to one of ordinary skill in the art to select a difunctional oligomer as the linking compound.

For these reasons, withdrawal of this rejection is in order.

Additionally, claims 5 and 37 recite that the difunctional oligomer comprises a reaction product of at least one diol and at least one diisocyanate, with the selected from the group consisting of ethylene glycol, propylene glycol, butylene glycol, 1,4-cyclohexanedimethanol, and any combination thereof. The claims of the co-pending application do not teach these features.

Claims 6 and 38 recite that the difunctional oligomer comprises a reaction product of at least one diol and at least one diisocyanate, with the

diisocyanate selected from the group consisting of hexane diisocyanate, methylene-bis(4-phenyl isocyanate), phenylene diisocyanate, toluene diisocyanate, xylylene diisocyanate, and any combination thereof. These features also are neither disclosed nor reasonable suggested by the claims of the co-pending application.

Finally, the claims of the co-pending application do not reasonably suggest using a difunctional oligomer comprising a urethane glycol, as set forth in claims 33 and 41 of this application.

For all of these reasons, reversal of this provisional rejection is in order.

**(c) *The Examiner Has Not Established a Prima Facie Case of Obvious Against Claims 1-11 and 33-34 Under 35 U.S.C. § 103(a)***

In numbered paragraph 10 of the final Office Action, claims 1-11 and 33-34 were rejected under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 4,806,613 to Wardle in view of Oertel, *Polyurethane Handbook: Chemistry - Raw Materials - Processing - Applications - Properties*.

Applicants respectfully traverse the Section 103(a) rejection.

Teachings of references can be combined only if there is some suggestion or motivation to do so. *Smithkline Diagnostics, Inc. v. Helena Lab. Corp.*, 859 F.2d 878, 886-87 (Fed. Cir. 1988). Here, the Wardle '613 patent relates to thermoplastic elastomers, but is silent regarding the use of an oligomer as the linking compound.

Oertel is fundamentally different from the Wardle '613 patent. Whereas the Wardle '613 patent focuses on the formation of an elastomer that is thermoplastic, Oertel relates to crosslinked thermosets. That is, the materials made by Oertel are not thermoplastic. A hypothetical person having ordinary skill in the art who, at the time the invention was made, attempted to make a thermoplastic elastomer such as disclosed in Wardle '613 would not have relied on a cross-linking mechanism, such as the one taught in Oertel. Cross-linking is associated with the formation of thermosets, not thermoplastic elastomers. The combination of the Wardle '613 patent with Oertel would be contrary to the goal of forming a thermoplastic elastomer.

For this reason alone, a *prima facie* case of obviousness has not been established, and the Section 103(a) rejection should be withdrawn.

Additionally, Oertel teaches making high molecular weight polyurethane-polyols from a two-component system. The first component is a **high molecular weight polyurethane**. The second component is an adduct of a polyisocyanate to a **triol**. This two-component system is fundamentally different from the claimed invention for the following reasons.

First, in the claimed invention, the polymer blocks are derived from oxetane, oxirane, and/or THF blocks. Oertel does not teach the use of these blocks. Given this fundamental difference, the requisite motivation for one of ordinary skill in the art to have used Oertel to make the claimed invention did not exist.

Second, in the claimed invention, the linking oligomer has two isocyanate-reactive moieties. On the other hand, Oertel uses as its second (crosslinking) component an “adduct of a polyisocyanate and a triol.” The triol second component is a crosslinker that will cause the composition to cure into a thermoset, not a thermoplastic elastomer. In contrast, the crosslinker of the claimed invention is a di-functional oligomer.

Third, Oertel teaches that its polyurethane diols are the main polymer blocks. These diols are high molecular weight polyurethane diols, which do not qualify as “linking groups” or oligomers as those terms are used in the art.

For these reasons, reversal of the Section 103(a) rejection is respectfully requested.

Additionally, claims 5 and 37 recite that the difunctional oligomer comprises a reaction product of at least one diol and at least one diisocyanate, with the selected from the group consisting of ethylene glycol, propylene glycol, butylene glycol, 1,4-cyclohexanedimethanol, and any combination thereof. The cited art does not teach or reasonably suggest these features.

Claims 6 and 38 recite that the difunctional oligomer comprises a reaction product of at least one diol and at least one diisocyanate, with the diisocyanate selected from the group consisting of hexane diisocyanate, methylene-bis(4-phenyl isocyanate), phenylene diisocyanate, toluene diisocyanate, xylylene diisocyanate, and any combination thereof. These features also are neither disclosed nor reasonable suggested by the cited art.

Finally, the cited art does not reasonably suggest using a difunctional oligomer comprising a urethane glycol in the manner set forth in claims 33 and 41 of this application.

**(9) CONCLUSION**

For all the above-discussed reasons, it is clear that the inventions recited in Applicants' claims are patentable over the art of record. Accordingly, reversal of the remaining rejection and allowance of claims 1-11 and 33-41 are respectfully requested.

Respectfully submitted,  
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**(10) APPENDIX: CLAIMS ON APPEAL**

1. A thermoplastic elastomer having A blocks and B blocks and being present in a solid state suitable for use as a binder for at least one of a propellant, explosive, and gasifier, the thermoplastic elastomer being formulated from a composition comprising, as constituents:

A blocks terminated with isocyanate-reactive groups derived from monomers comprising at least one member selected from the group consisting of oxetane derivatives and tetrahydrofuran derivatives, the A blocks being crystalline below about 60°C;

B blocks terminated with isocyanate-reactive groups derived from monomers comprising at least one member selected from the group consisting of oxetane and derivatives thereof, tetrahydrofuran and derivatives thereof, and oxirane and derivatives thereof, the B blocks being amorphous above about -20°C; and

linking groups derived from at least one diisocyanate for end-capping the A blocks and the B blocks and at least one difunctional oligomer comprising two functional groups which are reactive with isocyanate moieties of the diisocyanate.

2. A thermoplastic elastomer as defined in claim 1, wherein: the diisocyanate contains a first isocyanate moiety which is at least five times more reactive with the terminal groups of the blocks than a second isocyanate moiety thereof, whereby the more reactive first isocyanate moiety is capable of reacting with and end capping the terminal groups of the blocks, leaving the less reactive second isocyanate moiety free and unreacted; and

the difunctional oligomer has two isocyanate-reactive hydroxyl groups which are sufficiently sterically unhindered to be reactive with the free and unreacted second isocyanate moieties of the end-capped blocks.

3. A thermoplastic elastomer as defined in claim 2, wherein the diisocyanate comprises 2,4-toluene diisocyanate.

4. A thermoplastic elastomer as defined in claim 1, wherein the A blocks are crystalline below about 75°C.

5. A thermoplastic elastomer as defined in claim 34, wherein the difunctional oligomer comprises a reaction product of at least one diol and at least one diisocyanate, the diol being selected from the group consisting of ethylene glycol, propylene glycol, butylene glycol, 1,4-cyclohexanedimethanol, and any combination thereof.

6. A thermoplastic elastomer as defined in claim 1, wherein the difunctional oligomer comprises a reaction product of at least one diol and at least one diisocyanate, the diisocyanate being selected from the group consisting of hexane diisocyanate, methylene-bis(4-phenyl isocyanate), phenylene diisocyanate, toluene diisocyanate, xylylene diisocyanate, and any combination thereof.

7. A thermoplastic elastomer as defined in claim 1, wherein the thermoplastic elastomer has a weight average molecular weight of at least 40,000 and a number average molecular weight of at least 10,000.

8. A thermoplastic elastomer as defined in claim 1, wherein the thermoplastic elastomer has a weight average molecular weight of at least 60,000 and a number average molecular weight of at least 12,000.

9. A thermoplastic elastomer as defined in claim 1, wherein the thermoplastic elastomer has a weight average molecular weight of at least 80,000 and a number average molecular weight of at least 15,000.

10. A thermoplastic elastomer as defined in claim 1, wherein a weight ratio of A to B blocks is between about 15:85 to about 40:60.

11. A thermoplastic elastomer as defined in claim 1, wherein the isocyanate-reactive terminal groups of the A and B blocks are hydroxyl groups.

33. A thermoplastic elastomer as defined in claim 1, wherein the difunctional oligomer comprises a urethane glycol.

34. A thermoplastic elastomer having A blocks and B blocks and being present in a solid state suitable for use as a binder for at least one of a propellant, explosive, and gasifier, the thermoplastic elastomer being formulated from a composition comprising, as constituents:

A blocks terminated with isocyanate-reactive groups derived from monomers comprising at least one member selected from the group consisting of 3,3-(bis(ethoxymethyl)oxetane, 3,3-bis(chloromethyl)oxetane, 3,3-bis(methoxymethyl)oxetane, 3,3-bis(fluoromethyl)oxetane), 3,3-bis(acetoxyethyl)oxetane, 3,3-bis(hydroxymethyl)oxetane, 3,3-bis(methoxyethoxymethyl)oxetane, 3,3-bis(iodomethyl)oxetane, 3,3-bis(nitratomethyl)oxetane, 3,3-bis(methylnitraminomethyl)oxetane, and 3,3-bis(azidomethyl)oxetane), the A blocks being crystalline below about 60°C;

B blocks terminated with isocyanate-reactive groups derived from monomers comprising at least one member selected from the group consisting of 3-hydroxymethyl-3-methyloxetane, 3-octoxymethyl-3-methyloxetane, 3-chloromethyl-3-methyloxetane, 3-azidomethyl-3-methyloxetane, 3-iodomethyl-3-methyloxetane, 3-propynomethylmethyloxetane, 3-nitratomethyl-3-methyloxetane, 3-methylnitraminomethyl-3-methyloxetane, tetrahydrofuran, glycidyl azide, and glycidyl nitrate, the B blocks being amorphous above about -20°C; and

linking groups derived from at least one diisocyanate for end-capping the A blocks and the B blocks and at least one difunctional oligomer

comprising two functional groups which are reactive with isocyanate moieties of the diisocyanate.

35. A thermoplastic elastomer as defined in claim 34, wherein:

the diisocyanate contains a first isocyanate moiety which is at least five times more reactive with the terminal groups of the blocks than a second isocyanate moiety thereof, whereby the more reactive first isocyanate moiety is capable of reacting with and end capping the terminal groups of the blocks, leaving the less reactive second isocyanate moiety free and unreacted; and

the difunctional oligomer has two isocyanate-reactive hydroxyl groups which are sufficiently sterically unhindered to be reactive with the free and unreacted second isocyanate moieties of the end-capped blocks.

36. A thermoplastic elastomer as defined in claim 34, wherein the diisocyanate comprises 2,4-toluene diisocyanate.

37. A thermoplastic elastomer as defined in claim 34, wherein the difunctional oligomer comprises a reaction product of at least one diol and at least one diisocyanate, the diol being selected from the group consisting of ethylene glycol, propylene glycol, butylene glycol, 1,4-cyclohexanedimethanol, and any combination thereof.

38. A thermoplastic elastomer as defined in claim 34, wherein the difunctional oligomer comprises a reaction product of at least one diol and at least one diisocyanate, the diisocyanate being selected from the group consisting of hexane diisocyanate, methylene-bis(4-phenyl isocyanate), phenylene diisocyanate, toluene diisocyanate, xylylene diisocyanate, and any combination thereof.

39. A thermoplastic elastomer as defined in claim 34, wherein a weight ratio of A to B blocks is between about 15:85 to about 40:60.

40. A thermoplastic elastomer as defined in claim 34, wherein the isocyanate-reactive terminal groups of the A and B blocks are hydroxyl groups.

41. A thermoplastic elastomer as defined in claim 34, wherein the difunctional oligomer comprises a urethane glycol.